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HENRY HORNER, Governor

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The Mucous Membrane of the Nose*

Charles D. Sneller, M. D.
Peoria, Illinois

THE NOSE is a remarkable organ. It has many functions very essential to the well-being of the individual. By nose we refer not merely to that proboscis projecting from the middle of the face but more particularly to its interior. This interior is made up of a right and left chamber, each about 4½ inches long from the front to the back, about 2½ inches high, and about ½ to ¾ inch wide. It is the structure, the physiology, and the extent of this wall, or mucous membrane, with which this paper is concerned.

A very long time ago, between 500 and 1000 million years Paleontologists tell us, the most primitive form of animal life was a bit of animated "jelly" or protoplasm. This unicellular organism moved about in the primeval muck of the warm ocean. It must have had irritability, the power to react to its surrounding watery world, and to defend itself against destructive forces, i.e. chemical, physical, and living enemies. It must also have possessed the power of digestion and assimilation, so very essential to life itself. It must also have been able to remove oxygen from its watery environment. Lastly it surely possessed the power of reproduction so that life itself could move forward.

It was not long until external modifications of the protoplasm occurred. Finger-like processes grew out of the single cell. These cilia could move about and therefore came into greater contact with the world about. Locomotion was established. New territories were found. New experiences required adaptation and modification. And so were born cilia like those of our own mucous membrane which must have warmth, moisture, exact chemical surroundings and protection in order to function properly in this modern animal called man.

Next we come to a second consideration which takes us back to Devonian time about 350 million years ago. At this time the recently perfected backboned fish had appeared in the seas. They had made many experiments in form, size, and adaptation. The day arrived when they began to explore the shallow land streams. The hot and dry summer months came and these adventurers found themselves trapped in the dried-up pools or mud holes. Many died, but some had the power to accommodate themselves to their new environment. No longer could they take water through their gills and thereby get the oxygen needed for their very existence. Now those who were able quickly to develop

* Abstract address of the Retiring President. Presented before the General Session at the Twenty-ninth Annual Meeting of the Illinois Academy of Science, May 1, 1936.

a pouch in the front part of the foregut were able to make use of the first lung. This first lung must have been very crude. Today we find lung-fish in certain streams of Australia and South America. Their gills are used during the wet season, and their very primitive lungs come into their own as quickly as the stream dries up in hot summer months.

A third consideration deals with a concept of man as a whole. Man may be defined as a tubular mass of cells arranged into tissues and organs with a tube passing from one end, the mouth and nose, to the other, the anus. Just like simpler organisms, this tubular mass of cells is covered by a protecting coat called the skin or epidemics. The long tube is lined inside by a specially constructed coat called the mucous membrane. These coats, the external and internal, are the great protectors of the organism which lies between them. If the coats are intact, no enemy can enter the host. Life might go on forever in an organism were it not for the invading enemies which eventually destroy all.

The most remarkable part of this inner coat or protecting membrane is the nasal part. In this membrane "fortifications" have been built through long phylogenetic improvements for the defence of the grand array of cells and organs called the human being.

We have touched briefly upon the early history of the cilia, the formation of the primitive respiratory system and the relationship of these structures to the tubular mass called Man. Now let us consider briefly the more essential functions of the grand entrance to Man's interior, the NOSE.

The nose is divided into right and left chambers which run from the front part of the nose, seen on the face, back to the entrance into the throat—the naso-pharynx. Projecting into these chambers from the outer walls are three masses of extremely vascular tissue surrounding elongated pieces of bone. These masses are called turbinates and are under sympathetic nerve control.

The chambers of the nose are lined throughout by a mucous membrane. This is modified here and there by the presence of the turbinates and the openings to cavities called sinuses. The membrane is composed of an inner layer of ciliated epithelium and a submucous supporting layer. From each cell of this membrane project six to twelve little finger-like processes called cilia. There are also a great many little glands in this membrane which secrete a mucus. This constantly bathes it through its entire extent. The mucus consists of about 95 per cent water, 4 per cent mucin, and 1 per cent solids. The cilia are constantly bathed and wave back and forth in rythmic movements or "beats," six to eight times per second.

Rhythmic movements of cilia are in definite directions like wheat in a field being blown by the wind. Bits of carbon, when placed upon the mucous membrane in various places, are carried in these definite directions by the action of the constantly beating cilia. The nervous

system does not control their movements as demonstrated by taking bits of mucosa out of the nose, placing them in a physiological saline and seeing them still wave under a microscope. Here it can be observed that oils inhibit their movement while aqueous solutions of medications, such as ¼ per cent ephedrin, stimulate their action.

Of tremendous importance to the health of the Nation is the drying of this membrane during the cold months of the winter when most people are confined in steam-heated apartments. The amount of moisture in this air is so far below the amount in the nasal mucous membrane that some of the moisture leaves the membrane and passes into the air. As the membrane drys, the cilia have greater and greater difficulty in moving dirt, bacteria, and other injurious products and rendering them harmless. The cilia must have moisture for movement and life, just as the cilia in the most primitive organisms. The nasal mucous membrane is capable of secreting about one quart of water a day. If most of this passes into the drier air, the cilia must be rendered useless or must die.

Bacteria, which are always being harboured in or on the mucous part of the membrane, penetrate the membrane between the dead or dying cilia and get into the underlying tissues. We then have the condition we call inflamation of the nose. The membranes swell. We have difficulty in getting air through the nose. We absorb toxins or poisons which the bacteria are making. No longer is the remarkable bacteriolytic action of the mucus capable of helping to defend the entrance to the body. The temperature rises. We go to bed. We have a bad case of coryza due to the drying of the mucous membrane. It may not be long before the infection has spread downward into the lining of the larynx, trachea, and bronchi. If we are more fortunate we may escape pneumonia.

Extending outward and backward from the nasal chambers are about eighteen cavities in the bones of the face and skull. These are the sinuses. They act as resonating chambers for the voice. They are lined with a membrane thinner than that of the nasal chambers. These sinuses, usually nine on each side of the nose, may likewise become infected and then the well known sinus infection develops. Various ailments affecting many other parts of the body may in time develop from unhealed sinus infections. All of these conditions might have been avoided if care in the protection of the cilia, phylogenetically very old, had been instituted before they were dried out or killed.

It may be of interest at this point to compare the size of the nasal chambers to that of a large hall. If we were to magnify the chambers three thousand times, we would witness a hall 300 feet high with cilia about one inch in height covering the walls and with bacteria about 1/6 to 1/3 of an inch long moving in the layer of mucus. Many rooms would be found to lead out through single doors from the sides, near the roof, and backward. These rooms would likewise be lined with a ciliated

wallpaper. The halls would be kept moist by the thousands of mucous glands in the walls and would be kept warm by the two sets of radiators called turbinates. These would be suspended part way up the lateral walls. They would have pipes of blood vessels about as large and as close together as the pipes in the radiators of our houses. These pipes would, however, be elastic. They could swell so that more warm blood would rush into the radiators or they could shrink so that less heat would be brought into the chambers. All of this would be under the control of the marvelous sympathetic nervous system, really an electrical system, without conscious control.

SUMMARY

Man may be defined as a tubular mass of cells having two protective coats, one covering the outside and the other lining the central tube. The various organs lie between the two coats. The respiratory system is an outgrowth of the forepart of this tube, as in the lung-fish. The nose is one of the two entrances to the tube. It has developed into a remarkable organ for the protection not only of the respiratory system but also of the entire organism.

The nose has many functions, some of which are:

(1) Olfactory. The uppermost parts of the chambers have numerous end-organs for smell. They are but little developed in man as compared with many other animals.

(2) Respiratory. Air normally enters and leaves the respiratory system through the nose.

(3) Temperature regulator. The very vascular turbinates act as radiators to warm the air before it reaches the more delicate and sensitive bronchi and lungs.

(4) Moisture regulator. The entire respiratory system requires moisture in order that its ciliated mucous membrane may function. The mucous glands of the nose secrete about one quart of water a day.

(5) Expulsion of foreign matter. By the act of sneezing and by the ciliary action this matter is expelled.

(6) Bacteriostatic action. The mucus has the power to inhibit the growth of and often to kill many bacteria.

(7) Resonating chambers. The nasal chambers and the sinuses act as resonating chambers to improve the quality of the voice.

The Endocrine Glands

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It is an evident fact that the human body, in truth every living organism, must maintain itself in a relatively steady state (homeostasis). Life can exist only within certain limits of variation in the internal and external environment. Every action or change in the internal environment of the body is normally accompanied or followed by a compensatory action or change. For example, if an increased production of heat occurs in the body a mechanism is initiated for disposing of the heat; or when after a meal containing starches or sugar the blood sugar rises, a corrective process is instituted to decrease the blood sugar. The state of the body at any moment is a sum of the "positive" and "negative" processes going on.

In order to maintain a steady state, the bodily processes must be subject to excitation or inhibition; some way of speeding up or slowing down processes must exist.

The chief agencies through which bodily processes are augmented and retarded, or controlled, are: (1) the nervous system and (2) the hormone secreting cells or organs. The nerves, conducting nerve impulses, are nervous regulators of metabolism and the activities of the body. The hormones are chemical regulators of metabolism and the activities of the body. We are interested in this lecture in the hormonal regulation of the body, although in some instances the nerves regulate the production of hormones.

The hormones are secreted into the blood and/or lymph by glands without ducts, in contrast to such glands as the salivary glands. Hence, the terms "Ductless Glands" and "Glands of Internal Secretion" are applied to the hormone producing glands. The term, "Endocrine Glands" is also used, which means "to separate within." The hormones or internal secretions have been called autacoids, meaning self-remedial substances, because they act much like drugs or remedial agents. It is believed that two sorts of autacoids exist functionally, hormones (to excite) which speed-up bodily processes, and, chalones (to make slack), which slow-down bodily processes.

The endocrine glands concerning which we know most are as follows: The pituitary gland or hypophysis, which is located at the base of the brain almost in the center of the skull. It is divided into three parts, the anterior lobe, the posterior lobe and the intermediate part.

The parathyroids and the thyroid lobes are located in the neck just below the larynx and on each side of the trachea. The thymus, which may or may not produce a hormone is located in the upper part of the chest beneath the sternum or breast bone. The mucous lining of the stomach and upper intestine produce several hormones and a chalone. The "islets of Langerhans," cells located in the pancreas, secrete a hormone, the remainder of the pancreatic cells form the external or digestive secretion of the pancreas. The adrenal glands are located just above the kidneys. The ovaries and testicles, or the gonads, and the placenta secrete hormones. Some think that the liver secretes a hormone or hormones. In fact, there is some evidence which suggests that the endings of some nerves (autonomic nerves) give off hormones which actually cause smooth muscle to contract or relax and glands to secrete.

The Pituitary Gland.—The posterior lobe of the pituitary gland, which receives nerves from the hypothalamus or the base of the brain, controls water metabolism. When it or the appropriate region in the hypothalamus is destroyed or injured, as sometimes occurs in skull fracture, an animal or a human secretes a lot of pale urine (diabetes insipidus) and thirst is excessive. This abnormality may be corrected by injecting an appropriately made extract (pituitrin, antidiuretic principle) of the lobe subcutaneously. An extract of the gland (pituitrin, oxytoxic principle) may be made which causes the uterus to contract and is used rather extensively in obstetric practice.

The anterior lobe secretes a number of hormones, it is believed; some say two, others five, and still others say ten or twelve. When the anterior lobe is removed in a young animal, the animal does not grow and the gonads do not develop and the thyroid and adrenals atrophy (pituitary infantilism). In the adult slow cachexia (Simond's disease) and death may result. The following extracts may be made from the anterior lobe: (1) An extract, phyone or somototropin, that causes growth in hypophysectomized animals; (2) gonadotropin, follicle stimulating and lutein stimulating, that causes development of the testicles and ovaries, and certain changes in the ovary such as development of the follicle, corpus luteum, and ovulation; (3) prolactin, that causes development of the mammary gland and the secretion of milk; (4) thyreotropin, that causes growth of the thyroid; (5) adrenotropin that causes growth of the adrenals. There is also a relation between the anterior lobe and pancreatic or sugar diabetes. If the pancreas is removed from an animal it develops diabetes, the blood sugar rises abnormally and sugar is excreted in the urine. Now, if the anterior lobe is removed, the sugar usually disappears from the urine. Because of the diversified influences of the anterior lobe it has been referred to as "governor of the endocrines," the "motor of the ovaries," etc. If the anterior lobe does not produce adequate growth hormone, a pituitary dwarfism results. Such dwarfs may have normal gonads, and

reproduce normal offspring; yet, in many instances when growth hormone is not produced in adequate amounts, the gonad stimulating hormone is also inadequately produced. In such a case, of course, reproduction cannot occur. Sometimes boys or girls grow normally, but do not develop sexually, and become excessively fat (Froelich's syndrome, Dicken's fat-boy type). In such instances, a tumor of the anterior lobe may be found on X-ray examination. Although the failure of sexual development is generally ascribed to deficiency of the anterior lobe, the cause of the obesity is ascribed to a disturbance of the hypothalamus because it is claimed that with a normal anterior lobe an injury of the hypothalamus in the rat causes very marked obesity. In this connection it must be kept in mind that defective thyroid secretion may also cause obesity, but the type of obesity or the places at which excessive fat is deposited differs in the two conditions. In a few human patients anterior lobe extracts have been given with apparent improvement in the presence of stunted growth, stunted sexual development, and excessive obesity. Unfortunately, in many cases no improvement results; but it may be hoped that in the future more potent extracts for the human will be made and patients will be treated earlier when the possibility of success is greater.

When too much growth hormone is produced prior to or during pubertal growth, a pituitary giant (7-8 ft.) is said to result. When too much growth hormone is produced after 21 years of age, or after the period during which growth of the long bones occurs, then acromegaly occurs, in which condition the tip (acro) parts enlarge or continue to grow. The head, mandible, nose, lips, hands and feet enlarge. In acromegaly a tumor of the hypophysis is frequently found, which may be removed by operation. By giving growth hormone to hereditary dwarf-mice, mice of normal size have been produced; also, very large (giant) rats have been produced. When the growth hormone is given to young English bull dogs, an animal resembling an acromegalic human in certain particulars results.

The Thyroid.—The thyroid gland secretes thyroglobulin, a protein (globulin) plus a substance called thyroxin, according to present knowledge. It regulates the rate at which oxidation or combustion occurs in the body and in a specific manner. If too little is secreted, oxidation is abnormally low; if too much, oxidation is abnormally elevated. When the thyroid gland is removed from a young animal (e.g. rabbit, sheep) the mental and physical growth is stunted. This condition is called Cretinism and occurs in human babies or children. If desiccated thyroid is fed in proper amounts to Cretin animals or children, normal growth ensues. To obtain normal mental development thyroid should be fed early in the disease. A crystaline substance, thyroxin, has been isolated from the thyroid, which has the same effect as desiccated thyroid. Thyroxin contains idodine, the presence of which is necessary for potency. Iodine not only activates thyroxin, but it also apparently makes

it easier for the gland to secrete thyroxin and when present in an amount above that required for normal bodily needs, it causes the gland to store secretion ("colloid") in spaces within the gland. When the thyroid secretes hyponormally in the adult, the condition is called adult hypothyroidism. Hypothyroidism, of course, also occurs in childhood, but may not be sufficiently severe to cause obvious Cretinism, causing only lethargy, dullness, easy fatiguability, and a tendency toward obesity (hypothyroid obesity). The adult hypothyroid has similar symptoms, and then severe myxoedema of the skin occurs, in which condition the skin is thick and dry, the hair falls out, and the face appears to be "bloated." Like Cretinism, hypothyroidism with or without myxoedema responds to thyroid administration. Sometimes the thyroid is said to hypersecrete; the rate of oxidation is augmented, the heart beats rapidly, breathing is increased; the patient sweats easily, is irritable and the fingers are tremulous. That is, the patient is said to be suffering from hyperthyroidism, thyrotoxicosis, or a toxic goiter, if the thyroid is enlarged. In some exopthalmus (exopthalmic hyperthyroidism or goiter) occurs. The administration of iodine helps such patients; it sometimes controls the condition, but unfortunately it may rarely make the condition worse. In many cases the thyroid must be removed by a surgeon; it is occasionally treated with X-rays.

Goiter (enlarged thyroid) is believed to be due to a relative or absolute iodine deficiency. If iodine is given in proper doses to young sheep or to children who live in goiter regions, the occurrence of goiter is markedly reduced. Peculiarly goiter may be present without disturbing bodily processes or it may be associated with either hyper or hypothyroidism. The "situation" is very complicated.

The Parathyroids control calcium or lime metabolism chiefly, although phosphorus metabolism is frequently disturbed also. When the parathyroids are removed the calcium in the blood decreases, the muscles and nerves become more and more irritable, until finally the muscles begin to twitch violently and convulsions ensue. These symptoms may be controlled by the proper administration of calcium, or by the injection of parathyroid extract (parathormone or parathyrin). However, if too much extract is injected the blood calcium may become so high that death from calcium poisoning results.

The Thymus chiefly because it involutes or atrophies in most mammals at puberty and for other minor reasons is generally considered in a discussion of the endocrine glands. That it produces an internal secretion has never been proved. However, a very interesting observation has been made recently. If successive generations of rats are injected with an appropriately made extract of the thymus, the new-born rats of the 5th to 7th generation are much more precocious in regard to hair, body, and eye growth. For example, eight days after birth the rats whose ancestors received thymus have a heavy fur, their eyes are open,

and their weight may be as much as 37 gm., whereas the control rats have little or no fur, their eyes are closed, and they weigh only 11 gm. Just what this remarkable phenomenon means has not been determined.

The Islets of Langerhans in the pancreas produce insulin, which plays a very important role in sugar metabolism. I shall not repeat the remarkable story of this hormone, since I believe most of you are familiar with it. The use of the hormone, insulin, in the treatment of diabetes mellitus has saved and prolonged the lives of thousands of diabetic patients. There are at least one million people living in the United States today who, according to statistical studies, have or will develop diabetes and will benefit from the use of insulin.

The ovaries produce at least two hormones, one called theelin and the other progestin. Theelin or estrin has been crystalized. It is responsible for the development of the secondary female characters. In addition it causes certain specific premenstrual changes in the lining of the uterus and in the ducts of the mammary gland. Progestin is formed by the corpus luteum, which grows at the site of the follicle ruptured in the course of ovulation. It completes the preparation of the lining of the uterus for the implantation of the fertilized egg. If the egg is not fertilized and hence does not imbed in the uterus, the corpus luteum degenerates and menstruation results. The exact cause of menstruation, however, is still unsettled. Progestin or the corpus luteum is necessary for the maintenance of early pregnancy, because if removed in early pregnancy, abortion or death of the embryo occurs. In some animals progestin also acts on the mammary gland. Estrin increases and progestin decreases the irritability of the uterine muscle. The anterior lobe of the pituitary is concerned in the periodicity of the menstrual cycle. Relaxin is a hormone produced by the ovary. Together with theelin it causes softening and relaxation of the pelvic ligaments, thus increasing the size of the birth canal. In the pocket gopher estrin even causes a resorption of the symphysis pubis, thus enlarging the birth canal. Estrin also prevents or tends to prevent lactation.

The placenta produces estrin in large quantities and probably progestin also. In addition it produces emmenin (placental hormone) and a substance that is like, but not identical with, the gonad stimulating hormone of the anterior lobe of the pituitary.

All of these active principles have been and are being employed for certain female disorders, but it is too early to evaluate the results in a scientific manner.

The testes produce a hormone called androitin (crystalized), which causes the development of the secondary male characters. Some claim that a second hormone, or chalone, is produced, inhibin, which prevents excessive enlargment of the prostate gland.

The adrenals consist of two parts, the medulla and the cortex. The medulla produces epinephrine, or adrenin, which is thought to be given off during emotional excitement to assist the body in meeting the bodily emergencies associated with fight or flight. Hence, the so-called emergency function of the medulla of the adrenals. The medulla of the adrenals is not a vital structure. However, if the cortex is destroyed in animals, death results in a few days. In man it is sometimes destroyed slowly and Addison's disease, or chronic adrenal insufficiency, results which terminates in death. The active principle or hormone of the cortex may be extracted and is called cortin. Cortin keeps adrenalectomized animals alive and preserves the lives of patients with Addison's disease. In adrenal insufficiency the metabolism of sodium and potassium is deranged. The sodium in the blood decreases and the potassium increases to the extent that potassium poisoning results. Such animals are benefited markedly by giving sodium chloride. In fact, adrenalectomized animals may be maintained for months without cortin on a high sodium (sodium chloride and citrate) and low potassium diet.

The gastrointestinal hormones.—If extracts of the lining of the stomach are made and injected, gastric secretion is stimulated. The active principle has been called *gastrin.* It is apparently a chemical substance known as histamine. *Secretin* is a hormone produced by the lining of the upper intestine which causes the pancreas to secrete its very important digestive secretion. Cholecystokinin is a hormone produced by the upper intestinal lining, when acids and fats are eaten, which causes the gall bladder to contract and evacuate. Enterogastrone is a chalone which is produced chiefly by the intestinal lining when considerable fat and sugar is eaten. This chalone depresses gastric secretion and motility, i. e. it slows down gastric digestion apparently so that fat and sugar will not be delivered to the intestine at too rapid a rate.

It should be obvious from this very brief review that the endocrine glands play a very important and essential role, a vital role in many instances, in regulating the processes occurring in the internal environment of our body., We know considerable about the subject at present, but more is to be learned. In numerous instances we can produce, prevent and control defects of the endocrine glands in animals, and much of this knowledge has been, and more in the future, may be applied successfully to human beings afflicted with grave disturbances of endocrine function. Many lives have been saved, prolonged, and made happier. The future outlook is even brighter.

(This lecture was illustrated with sixty lantern slides.)

MEMOIRS

[9] WALTER GAVIN BAIN, M. D.

PRESIDENT OF THE ILLINOIS STATE ACADEMY OF SCIENCE, 1925

1876–1935

Scientist, patriot, citizen. Those three words express more accurately than any others the dominating attributes of Walter G. Bain whose useful life was terminated unexpectedly at the age of 59 years on Christmas eve, 1935, as a result of a surgical operation. He was a physician, an educator, a soldier and a gentleman whose word was his bond. He looked at life through the eyes of a realist, had always a definite purpose in view which he pursued relentlessly in season and out, and patterned his work on a foundation of logic and science that left no room for skepticism or equivocation with respect to the righteousness and useful importance of any cause toward the achievement of which he bent his efforts. Intolerant of hypocrisy, indolence, indifference, intrigue and carelessness, he was himself the epitome of forthrightness and efficiency that was raised to the nth degree through a loyalty and perseverance that made dependability and effectiveness a part of his very personality.

While his efforts were spent chiefly in the field of medicine Dr. Bain's scientific interests were broad and versatile. His principal achievement in the professional field was the building up of a diagnostic laboratory and a training school for nurses at St. John's Hospital in Springfield. The laboratory was his particular work. Through twenty years of effort the laboratory at the hospital was built up and expanded largely through his efforts and vision from a minor to a major unit, which served not only the institution of which it was a part, but likewise the entire community. He became a pathologist of state-wide reputation, while his laboratory enjoyed a confidence that resulted in an expansion of service unsurpassed among private endeavor in central Illinois.

Dr. Bain's interest in education expressed itself through the nurses' training school at St. John's Hospital. Recognizing the importance of a liberal outlook on life for professional people, he succeeded in adding to the curriculum of the school an academic course of study that was taught in a way which commanded college credits. He introduced a system of medical examinations of applicants for nurse training and of annual medical examinations of those accepted.

Dr. Bain's ardent patriotism was expressed through the practical channel of militarism. As a major during the World War he served his country overseas in command of a hospital evacuation detachment.

After the War he identified himself with the medical reserve corps of the United States Army and organized the 55th Evacuation hospital detachment of which he was the commander with the rank of colonel. He spent a great deal of energy in successfully building up the reserve officers association in his community and state. At stated intervals he assembled the commissioned personnel of his own reserve detachment at the hospital for training programs which were carried out in strict military fashion according to army regulations. Each of his three sons were trained in the Citizens Military Training units so that each became a commissioned officer in the reserve army of the United States. One son graduated in the army aviation schools. None, however, selected military service as a career. These observations betray the practical and realistic outlook of a peace-loving man of intense patriotic leanings.

The forthright character and unadulterated honesty of the man is illustrated by an incident which occurred during the era when hit-and-run automobile accidents were regarded with more tolerance than now. He drove into a narrow street one evening about dusk and damaged slightly the fender of an unoccupied car, which was almost blocking the right-of-way. Without an instant's hesitation, as if the action had been completely automatic, he stopped his car, went in search of the owner of the damaged vehicle who was nowhere to be seen, and left the scene only after the incident had been satisfactorily explained. The damage was so slight that the owner dismissed the matter with a wave of his hand. This relatively trifling event gives an insight into a quality of character that explains the meticulous care with which Dr. Bain jealously guarded the integrity of his relations with fellow creatures.

Born in 1876, Dr. Bain graduated from Northwestern Medical College in 1905 and was licensed to practice medicine in Illinois the same year. His associations with professional organizations included fellowship in the American Medical Association and membership in the American Society of Clinical Pathologists, and in the Radiological Society of North America. He held membership also in the State Academy of Science, of which he was president in 1925, the American Academy of Science, the Reserve Officers Association of the United States, the Rotary Club and numerous other civic organizations. Dr. Bain was chief of the diagnostic laboratories of the Illinois State Department of Public Health from 1907 to 1909 after which he became identified with St. John's Hospital in Springfield as head of the diagnostic and clinical laboratory. Aside from building up the laboratory, he developed a record keeping system of unusual efficiency. He served the Sangamon County Medical Society and the Springfield Chapter of the Reserve Officers Association as president in 1925 and 1924, respectively.

B. K. Richardson

THOMAS LEROY HANKINSON

1876–1935

The Academy lost one of its charter members on December 3, 1935, when Thomas Leroy Hankinson died at Ypsilanti, Michigan after a short period of severe illness. For several years his health had gradually failed. He is survived by Mrs. Hankinson, and by their daughter Janet (Mrs. Richard Ford) of Detroit.

He was born at Valparaiso, Indiana on April 12, 1876. His parents died while he was a young boy; he was brought up at the home of his uncle at Hillsdale, Michigan, later living for a time at Skaneateles, New York. His interest in natural history developed early, no doubt stimulated by the lakes and woods near Hillsdale, as we learn from the obituary notice by Dr. Carl L. Hubbs in *Science* of January 3, 1936 (vol. 83, p. 8). Other items here included have been obtained from Dr. Hubb's article.

Thomas Hankinson attended the Michigan State College, receiving a degree from that institution in 1898, and one from Cornell in 1900. His studies at Cornell continued for two additional years. In 1902 he began teaching zoology at the Eastern Illinois State Normal School at Charleston. While there he married Nettie Belle Dickson. During a number of summers he served as investigator for the Michigan Biological and Geological Survey, for the Illinois Natural History Survey, and after 1915, the Roosevelt Wild-Life Experiment Station of Syracuse, New York. His publications on Walnut Lake, Michigan (1907, 1910), on the vertebrate life near Charleston (1915), and Oneida Lake (Adams and Hankinson, 1928), are results of this work. Summer studies were carried on also in North Dakota in 1922, in Michigan (for the state department of conservation), 1923 to 1925, and Ohio (division of conservation), 1930.

From 1919 to 1921 Professor Hankinson was a member of the staff of the Roosevelt Wild Life Experiment Station. From 1921 until he died he was professor of zoology at Michigan State Normal College at Ypsilanti. During the last few years he was also affiliated with the Museum of Zoology, University of Michigan, as research associate.

Professor Hankinson was one of the most active members of the Illinois State Academy of Science from its inception until his removal from the state, thereafter retaining his membership and his interest in its work. He was treasurer of the Academy from 1917 until 1919. Some of his papers were presented at the annual meetings and published in the Academy's Transactions, notably in volumes 3, 10, and 12. He belonged to a number of other science organizations: American Asso-

ciation for the Advancement of Science, Ecological Society (vice-president, 1919), Society of Ichthyologists and Herpetologists (treasurer, 1930), Fisheries Society, Society of Mammalogists, Microscopical Society (treasurer 1910-15, vice-president, 1916), Wilson Ornithological Club (secretary, 1915, president, 1922-24), Michigan Academy of Science.

His published works deal with ecology and vertebrate faunas of freshwater habitats, and to a lesser extent land vertebrates. Distribution, habits, and life-histories of fishes, in later years with emphasis upon cyprinids, were his central interests. His enthusiasm left its impress upon his students, and his helpful attitude toward his colleagues endeared him to them.

A. G. VESTAL